DOCUMENT RESUME

ED 240 471 CG 017 303

AUTHOR Thomas, Jeanne L.
TITLE Locational versus Featural Information in Adult Visual Memory.
PUB DATE Aug 83
NOTE 28p.; Paper presented at the Annual Convention of the American Psychological Association (91st, Anaheim, CA, August 26-30, 1983).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Age Differences; Aging (Individuals); *Cognitive Processes; Eidetic Imagery; Females; Maps; *Memory; Middle Aged Adults; Older Adults; *Spatial Ability; *Visual Discrimination; Visual Learning; Young Adults

ABSTRACT

Research on adult memory for nonverbal representations has found a significant age-related decrement in performance. To investigate age differences in adult locational versus featural information in visual memory, 90 adult women (29 young women with a mean age of 21; 30 middle aged women with a mean age of 43; and 31 older women with a mean age of 68.7) studied three stimulus maps for landmarks, location recognition, and landmark-location pairing over three trial blocks; they then completed cumulative retention tests following learning of each stimulus map. After the map exercise, subjects completed a questionnaire covering learning strategy use and demographic information. An analysis of the results showed that the young and the middle aged subjects did not differ significantly in performance. Both younger groups recognized significantly more landmarks and locations, and paired significantly more landmarks and locations than did the elderly subjects. Subjects generally recognized similar numbers of landmarks and locations, although the young subjects recognized significantly more landmarks than locations from the third stimulus map, apparently stemming from practice in using a verbal labelling learning strategy. Relative levels of performance on the two recognition tasks and the pairing task indicated that recognition of featural and locational information were generally tasks of comparable difficulty, and that both were less difficult than the task of integrating featural and locational information. The findings of age group differences in performance may indicate an age related decrement in visual memory ability, but may also reflect age group differences in response to specific features of the experimental task. (Author/BL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED240471

Locational versus Featural Information in Adult Visual Memory

Jeanne L. Thomas, Ph.D.[1]

West Virginia University

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Jeanne L. Thomas

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Contribution to symposium on "Adult Age Differences in Visual and Spatial Memory" (R. E. Till, Chair) presented at the Annual Meeting of the American Psychological Association, Anaheim, CA, August, 1983.

[1]Current address: Division of Behavioral Sciences, University of Wisconsin-Parkside, Kenosha, WI 53141

CG 017303

Abstract

This study considered adult age differences in map landmark and map location recognition and in map landmark-location pairing. Young, middle aged, and elderly women (mean ages 21.1, 43.2, and 68.7, respectively) studied three stimulus maps over three trial blocks; cumulative retention tests followed learning of each stimulus map. The young and the middle aged subjects did not differ significantly in performance; both younger groups recognized significantly more landmarks, recognized significantly more locations, and paired significantly more landmarks and locations than did the elderly subjects. Subjects generally recognized similar numbers of landmarks and locations, although the young subjects recognized significantly more landmarks than locations from the third stimulus map; the latter finding apparently stemmed from practice in using a verbal labelling learning strategy. Relative levels of performance on the two recognition tasks and the pairing task indicated that recognition of featural and of locational information are generally tasks of comparable difficulty, and that both are less difficult than the task of integrating featural and locational information. The findings of age group differences in performance may indicate an age related decrement in visual memory ability, but may also reflect age group differences in response to specific features of the experimental task.

Locational versus Featural Information in Adult Visual Memory

Even the most casual survey of research on the psychology of aging reveals a long-standing commitment to the study of adult memory development. Over the past two decades, investigators have shown increased interest in memory for nonverbal representations. The visual stimuli used in these studies have included abstract designs (e.g., Botwinick and Storandt, 1974; Howell, 1972; Riege and Inman, 1981), geometric figures (e.g., Benton, 1963; Kendall, 1962), and photographs of faces (e.g., Smith and Winograd, 1978). Researchers have also varied in their choices of visual memory tasks, with some investigators employing recognition tests and others using reproduction measures. The typical finding of these studies is of a significant age-related decrement in performance.

In a recent review, Hartley, Harker, and Walsh (1980) emphasize the need for greater ecological validity in research on adult memory development; they suggest further that a means toward this end is the study of age-related trends in memory for spatial information. One study of this sort was conducted by Perlmutter, Metzger, Nezworski, and Miller (1981), who compared the performance of young and elderly adults on a map memory task. The time required for task completion significantly increased with age, while the amount of material recalled decreased significantly with age.

The goal of the present study was to provide a still more detailed view of adult age differences in remembering spatial information. Using a map memory task similar to that of Perlmutter et al. (1981), this study

addressed four research questions. First, do young, middle aged, and elderly adults differ significantly in memory for featural map information, e.g., in the numbers of map landmarks recognized? Second, do these age groups differ significantly in memory for locational map information, e.g., in the numbers of map locations recognized? Third, do these age groups differ significantly in integration of featural and locational map information e.g., in the numbers of map landmarks and locations correctly paired? Finally, what are the relative levels of performance within each age group on the task components of landmark recognition, location recognition, and landmark-location pairing?

On the basis of Perlmutter et al.'s (1981) findings, significant age group differences in correct landmark-location pairing were expected. On the basis of earlier studies of visual recognition performance, significant age group differences in both landmark recognition and in location recognition were also anticipated. Finally, subjects in each age group were expected to recognize similar numbers of map landmarks and locations, but to correctly pair significantly fewer landmarks and locations than they had recognized: thus, the integration of featural and locational information was expected to be more difficult for adults of all ages than simply remembering either type of information.

Method

Subjects

Twenty-nine young women (ages 17-25; mean age 21.1), 30 middle aged women (ages 39-50; mean age 43.2), and 31 elderly women (ages 60-80; mean age 68.7) participated in the experiment; the three age groups did not differ significantly in educational level ($F_{(2,87)} = 1.40$, $p < .25$; mean years of formal education: Young = 14.7, Middle aged = 15.4,

Elderly = 15.4). All subjects were volunteers, and were either West Virginia University undergraduates or alumnae, local residents, or participants in local Elderhostel programs. Approximately one third of the subjects in each age group were randomly assigned to each of three stimulus map presentation order conditions.

Materials

Three stimulus maps, each showing the same street layout with eight landmarks, were used; a sample stimulus map appears in Figure 1. A different set of landmarks appeared on each stimulus map, and landmarks appeared in different locations on each stimulus map. All stimulus maps measured 19.7 cm by 15.9 cm, and were mounted on a white background measuring 27.9 cm by 21.5 cm.

Insert Figure 1 about here

Test pages were used to assess retention of the map landmarks and their locations. On the test pages, the street layout of the stimulus maps appeared, but this time without landmarks; possible landmark locations were indicated by blank boxes on the test page maps. All 24 of the landmarks appearing on the stimulus maps, together with 14 distractor landmarks, were numbered and randomly ordered, and displayed beside the street layout on the test pages. Each subject was tested with a random ordering of three copies of each of four test page forms; the four test page forms differed in random orderings of landmarks. The stimulus maps and the test pages were adapted from the Building Memory Test published by the Educational Testing Service.

All landmarks were similar in scale and complexity. The three sets of landmarks appearing on the stimulus maps and the set of distractor landmarks all contained items of similar distributions of visual distinctiveness, as measured by the ratings of ten independent judges.

Procedure

The procedure consisted of 12 study-test period trials. Each of the three stimulus maps was presented for a trial block of four 20 second study periods; a subject-paced test interval followed each study period. In each test interval, the subject's task was to recognize all landmarks that had been presented, to recognize the locations of all landmarks that had been presented, and to correctly pair each landmark with its stimulus map location. Thus, during the first trial block (trials 1-4), the subject recognized and paired the eight landmarks and locations of the first stimulus map. During the second trial block (trials 5-8), the subject recognized and paired the 16 landmarks and locations of the first and second stimulus maps combined. During the third trial block (trials 9-12), the subject recognized and paired the 24 landmarks and locations of all three stimulus maps combined. After testing, the subject completed a questionnaire covering learning strategy use and demographic information.

Results

A multivariate analysis of variance, with factors of age group and presentation order, was initially performed; univariate analyses of variance, Scheffé tests, and the Least Significant Difference test were used for subsequent analyses. The dependent variables were the mean numbers of landmarks recognized, the mean numbers of locations recognized,

and the mean numbers of landmarks and locations correctly paired from each of the three stimulus maps. Table 1 presents age group means for each dependent variable.

Insert Table 1 about here

The multivariate analysis indicated that the three age groups differed significantly in performance, Wilk's lambda = .40387, approximate F (18,146) = 4.65210, $p < .01$. Performance of the three presentation order groups also differed significantly, Wilk's lambda = .52282, approximate F (18,146) = 3.10657, $p < .01$. The age group by presentation order interaction did not reach statistical significance, Wilk's lambda = .75031, approximate F (36,275) = .60926, $p < .96$.

The three age groups differed significantly on all dependent variables, F's (2,81) $\geq$ 17.36599, p's $< .01$. The means for each dependent variable were compared using the Scheffé procedure for a posteriori contrasts $\alpha = .01$). On each dependent variable, performance of the young and the middle aged subjects did not differ significantly, but the scores of both younger groups significantly exceeded those of the elderly subjects (see Table 1). Thus, as shown in Figure 2, the young and the middle aged subjects, compared to the elderly subjects, recognized significantly more landmarks, recognized significantly more locations, and correctly paired significantly more landmarks and locations from each stimulus map.

Insert Figure 2 about here

The presentation order groups differed significantly in mean numbers of landmarks and locations correctly paired from the second stimulus map, F (2, 81) = 3.3.843, $p < .04$; subjects tested using presentation order 1 correctly paired fewer landmarks and locations than subjects tested using presentation order 3, $p < .03$. Table 2 displays presentation order group means for the numbers of landmarks and locations correctly paired from the second stimulus map, together with the critical difference value for the Least Significant Difference test.

Insert Table 2 about here

Within each age group, performance on the three task components (landmark recognition, location recognition, and landmark-location pairing) were compared, using correlated t tests. The mean numbers of landmarks recognized did not differ significantly from the mean numbers of locations recognized from any stimulus map for either the middle aged subjects or the elderly subjects, p's > .20. The young subjects, however, recognized significantly more landmarks than locations from the third stimulus map, t (28)= 2.33, $p < .023$; the young subjects' recognition of landmarks and locations from the first and second stimulus maps did not differ significantly, t's (28) $\leq$ 1.56, p's > .13. Subjects in all age groups recognized significantly more landmarks than the number of landmarks correctly paired with locations from each stimulus map, p's < .0001; similarly, subjects in all age groups recognized significantly more locations than the number of locations correctly paired with landmarks from each stimulus map,

p's < .0001. The t test values for these comparisons and their associated probability values appear in Table 3.

Insert Table 3 about here

Discussion

The major findings of the study, then, are threefold. First, the performance of the young and the middle aged subjects significantly exceeded the performance of the elderly subjects in landmark recognition, in location recognition and in landmark-location pairing. Second, recognition of landmarks and of locations were tasks generally eliciting similar performance levels within each age group; the exception was the young subjects' greater recognition of landmarks than of locations from the third stimulus map. Third, the correct pairing of map landmarks and locations elicited a lower performance level within each age group than did the recognition of either map landmarks or map locations. Thus, young and the middle aged subjects outperformed the elderly subjects in remembering both featural and locational map information, as well as in integrating these types of information; remembering the two types of information were tasks of generally comparable difficulty, and both tasks were less difficult than the task of integrating the two types of information. The findings generally conform to the hypothesized pattern of results, as well as to the results of earlier research.

The young subjects' greater proficiency in recognizing landmarks than locations from the third stimulus map had not been anticipated, and

was an anomaly in the overall result pattern. A possible explanation lies in the young subjects' reported learning strategy use. After the map learning procedure, all subjects had described their learning strategies; most young subjects had reported giving names to each map landmark, while most older subjects reported using other learning techniques. It is possible that this verbal labelling strategy was especially beneficial for recognizing individual landmarks, but that practice was necessary for a significant benefit to appear. Since self-reports were the measure of learning strategy use, this interpretation is tentative; research in which map learning strategy is manipulated through instructions is needed to evaluate the validity of this explanation.

On the basis of the observed age group differences in performance, one might conclude that the ability to remember visual information decreases during adulthood. Since age differences in recognition were identified, one might further conclude that this ability decrement reflects problems of acquisition and/or storage. Several factors, however, point to the need for caution in drawing these conclusions.

First, the usual precautions concerning the interpretation of findings of age differences as evidence of age changes in behavior apply to this study; a sequential research design could more precisely document the source of the observed age group differences in performance (Schaie, 1965). Equally important, these age group differences may have resulted from differences in response to the experimental task, rather than from ability differences. The pacing of the experimental task, for example, might have hindered the performance of the older subjects. Studies of adult age differences in

verbal memory show that older subjects often benefit when an unhurried acquisition period is provided (for a review, see Botwinick, 1978). Perlmutter et al.'s (1981) findings, however, suggest that elderly adults' landmark-location pairing performance, at least, might not improve with additional study time.

The meaningfulness of the experimental task may also be an important factor. Labouvie Vief (1980) discussed the importance of task meaningfulness in research on adult cognition, noting that older subjects in her own investigations had refused to cooperate on tasks of no apparent personal relevance. Other researchers have found that increasing the concreteness - and thus, perhaps, the meaningfulness - of experimental tasks yields special benefits for the aged (e.g., Arenberg, 1968).

In this study, the elderly subjects -- but not the younger adults -- frequently described the map learning task as tedious, difficult, and totally divorced from their everyday experience; many felt that their performance did not accurately reflect their actual memory ability. Perhaps, then, if an experimental task more appealing to adults of all ages were employed, less marked age group differences in performance would appear.

Thus, one area for further research on adult age differences in visual memory is the specification of task features having a significant impact upon the performance of the elderly. With the isolation of performance relevant task characteristics, more precise examinations of actual ability differences can be made. A second, closely related, area for further study is the identification of means to improve older adults'

visual memory performance; this information would be particularly useful to environmental designers, advertisors, educators, and other professionals serving the aged. As investigators pursue these sorts of questions, we should be able to provide more satisfying statements of the sources and implications of the type of age differences in visual memory performance that these data describe.

References

Arenberg, D. Concept problem solving in young and old adults. Journal of Gerontology, 1968, 23, 279-283.

Benton, A. L. The revised visual retention test: Clinical and experimental applications. New York: The Psychological Corporation, 1963.

Botwinick, J. Aging and behavior: A comprehensive integration of research findings. New York: Springer Publishing Co., 1978.

Botwinick, J. and Storandt, M. Memory, related functions, and age. Springfield, IL: Charles C. Thomas, Publishers, 1974.

Craik, F. I. M. Age differences in human memory. In J. E. Birren and K. W. Schaie (Eds.), Handbook of the psychology of aging. New York: Van Nostrand Reinhold Co., 1977.

Hartley, J. T., Harker, J. O., and Walsh, D. A. Contemporary issues and new directions in adult development of learning and memory. In L. W. Poon (Ed.), Aging in the 1980's: Psychological issues. Washington, D.C.: American Psychological Association, 1980.

Howell, S. C. Familiarity and complexity in perceptual recognition. Journal of Gerontology, 1972, 27, 364-371.

Kendall, B. S. Memory for Designs performance in the seventh and eighth decades of life. Perceptual and Motor Skills, 1962, 14, 399-405.

Labouvie Vief, G. Adaptive dimensions of adult cognition. In N. Datan and N. Lohmann (Eds.), Transitions of aging. New York: Academic Press, 1980.

Perlmutter, M., Metzger, R., Nezworski, T., and Miller, K. Spatial and temporal memory in 20 and 60 year olds. Journal of Gerontology, 1981, 36, 59-65.

Riege, W. H. and Inman, V. Age differences in nonverbal memory tasks. Journal of Gerontology, 1981, 36, 51-59.

Schaie, K. W. A general model for the study of developmental problems. Psychological Bulletin, 1965, 64, 92-107.

Smith, A. D. and Winograd, E. Adult age differences in remembering faces. Developmental Psychology, 1978, 14, 443-444.

Table 1

Age Group Mean Scores for Landmark Recognition, Location Recognition, and Landmark-Location Pairing from Each Stimulus Map

Age Group	Score		
	Landmark Recognition[1]	Location Recognition[1]	Landmarks and Locations Paired[1]
Stimulus Map 1			
Young (17-25) n = 29	6.66 (1.22)	6.60 (1.42)	5.72 (1.82)
Middle Aged (39-50) n = 30	5.87 (1.34)	6.01 (1.47)	4.98 (1.65)
Elderly (60-80) n = 31	3.90 (1.79)[2]	3.88 (1.74)[3]	2.31 (1.61)[4]
Stimulus Map 2			
Young (17-25) n = 29	6.92 (1.18)	6.78 (1.16)	6.23 (1.56)
Middle Aged (39-50) n = 30	6.13 (1.12)	6.07 (1.26)	5.02 (1.75)
Elderly (60-80) n = 31	4.08 (1.78)[5]	4.15 (1.78)[6]	2.61 (1.72)[7]

Table 1 Continued

	Stimulus Map 3		
Young (17-25) n = 29	6.58 (1.05)	6.33 (1.33)	5.77 (1.52)
Middle Aged (39-50) n = 30	5.94 (1.32)	5.84 (1.24)	4.80 (1.54)
Elderly (60-80) n = 31	4.60 (1.47)[8]	4.32 (1.42)[9]	2.58 (1.44)[10]

Note. Standard deviations appear in parentheses

[1] Maximum possible score = 8

[2] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.21)

[3] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.29)

[4] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.37)

[5] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.14)

[6] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.14)

[7] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.33)

[8] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.08)

Table 1 Continued

[9] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.07)

[10] Score of elderly differs from scores of young, middle aged, $p < .01$ (Scheffé critical difference = 1.22)

Table 2

Landmarks and Locations Paired from

Second Stimulus Map: Presentation Order Group Means

Presentation Order		
1[1]	2	3[1]
(Map 1, Map 2, Map 3)	(Map 2, Map 3, Map 1)	(Map 3, Map 1, Map 2)
4.00	4.81	4.93

[1] Order group means differ, $p < .03$. (Least Significant Difference test critical value = .852)

Table 3

Contrasts Among Scores Within Age Groups:

t Test Values and Probability Levels

Contrast	Stimulus Map 1	2	3
	Young Subjects		
Landmark Recognition vs Location Recognition	t (28) = .45, $p < .66$	t (28) = 1.56, $p < .13$	t (28) = 2.33, $p < .03$
Landmark Recognition vs Landmark-Location Pairing	t (28) = 5.43, $p < .0001$	t (28) = 5.57, $p < .0001$	t (28) = 6.47, $p < .0001$
Location Recognition vs Landmark-Location Pairing	t (28) = 6.12, $p < .0001$	t (28) = 5.91, $p < .0001$	t (28) = 5.80, $p < .0001$
	Middle Aged Subjects		
Landmark Recognition vs Location Recognition	t (29) = 1.27, $p < .22$	t (29) = .48, $p < .64$	t (29) = .89, $p < .38$
Landmark Recognition vs Landmark Location Pairing	t (29) = 7.02, $p < .0001$	t (29) = 6.29, $p < .0001$	t (29) = 8.41, $p < .0001$
Location Recognition vs Landmark-Location Pairing	t (29) = 7.95, $p < .0001$	t (29) = 8.17, $p < .0001$	t (29) = 8.05, $p < .0001$

Table 3 Continued

	Elderly Subjects		
Landmark Recognition vs Location Recognition	t (30) = .17, p < .87	t (30) = .43, p < .67	t (30) = 1.58, p < .13
Landmark Recognition vs Landmark-Location Pairing	t (30) = 9.17, p < .0001	t (30) = 11.32, p < .0001	t (30) = 13.26, p < .0001
Location Recognition vs Landmark-Location Pairing	t (30) = 9.55, p < .0001	t (30) = 10.46, p < .0001	t (30) = 8.30, p < .0001

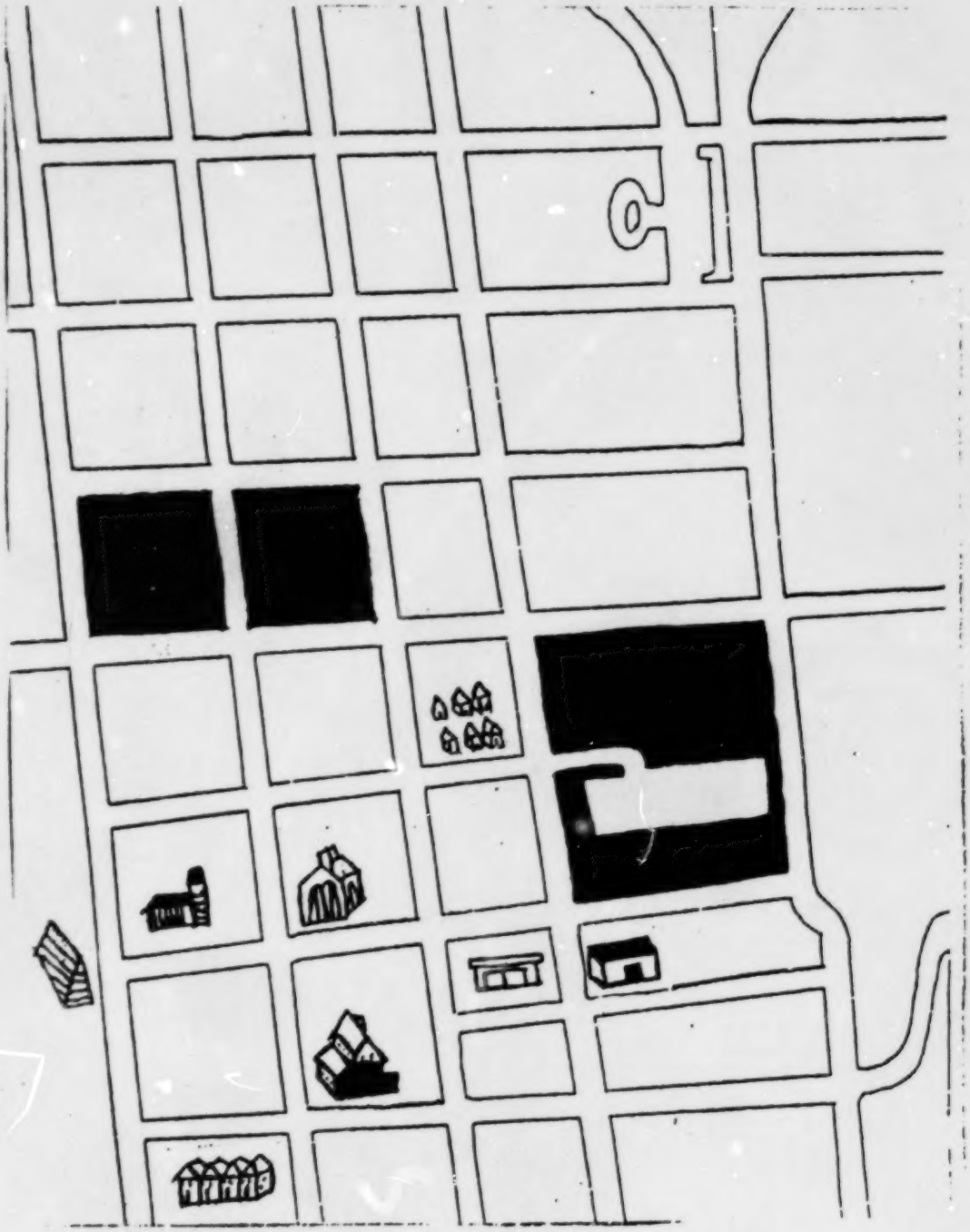
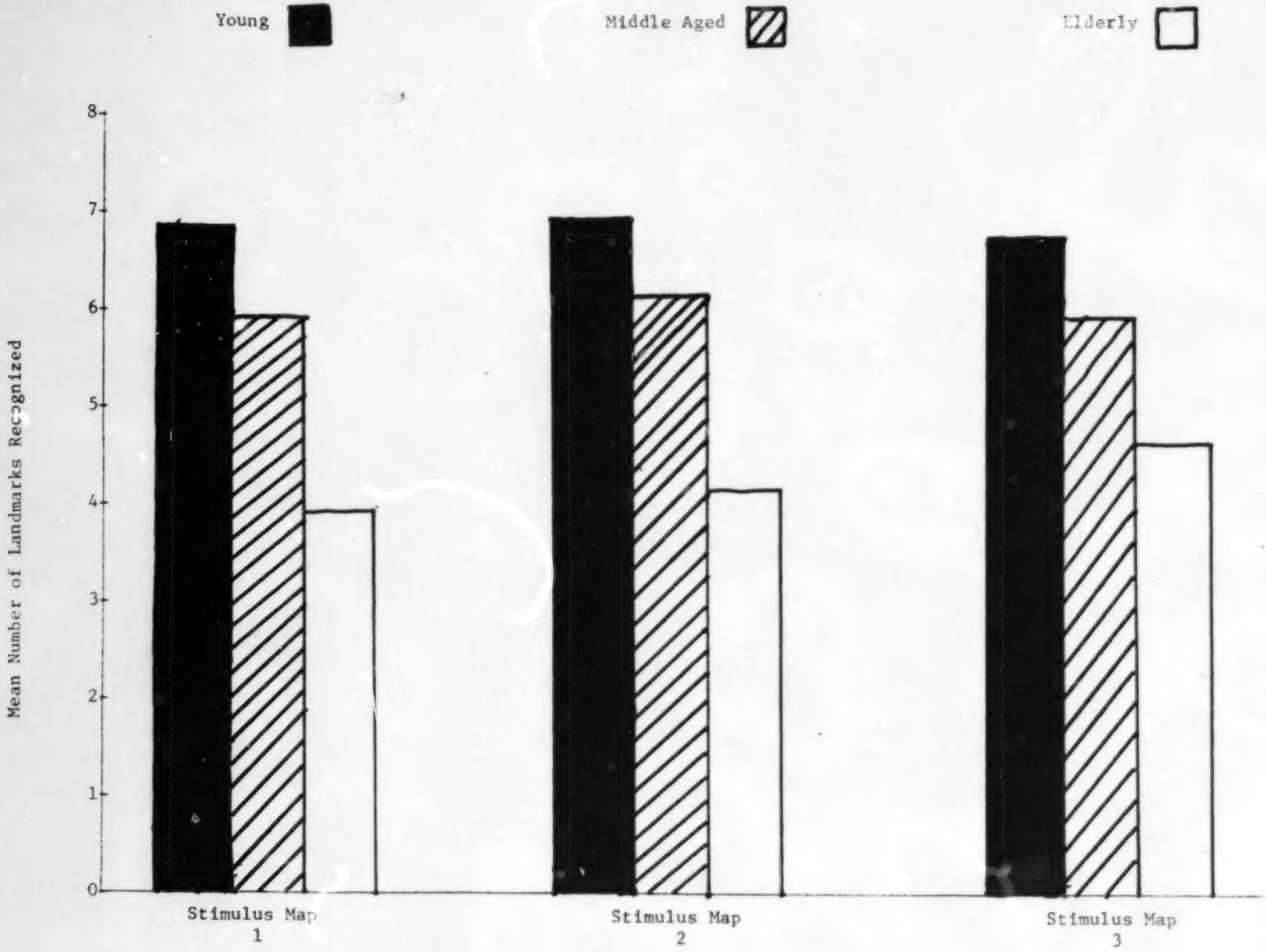
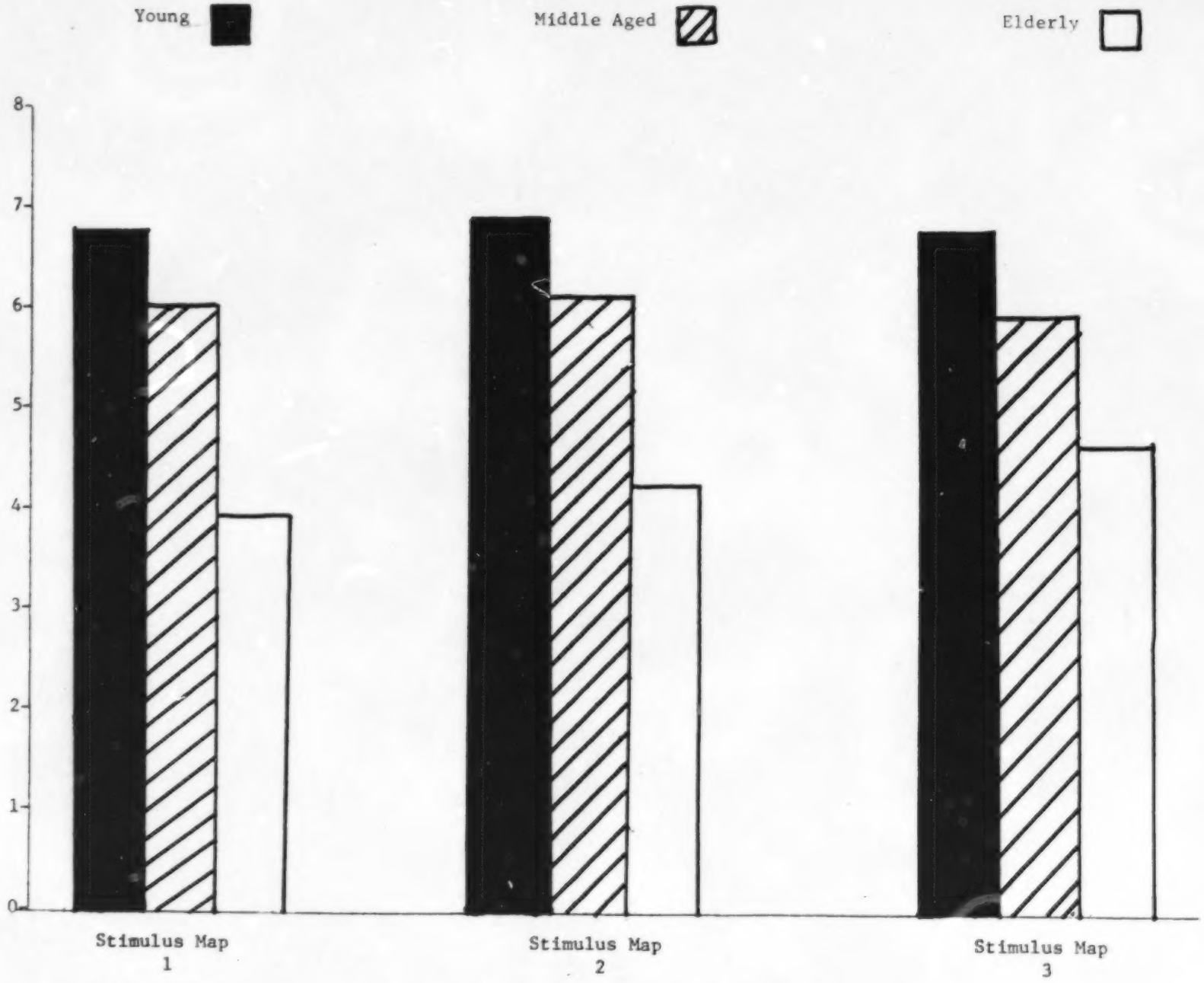


Figure 1

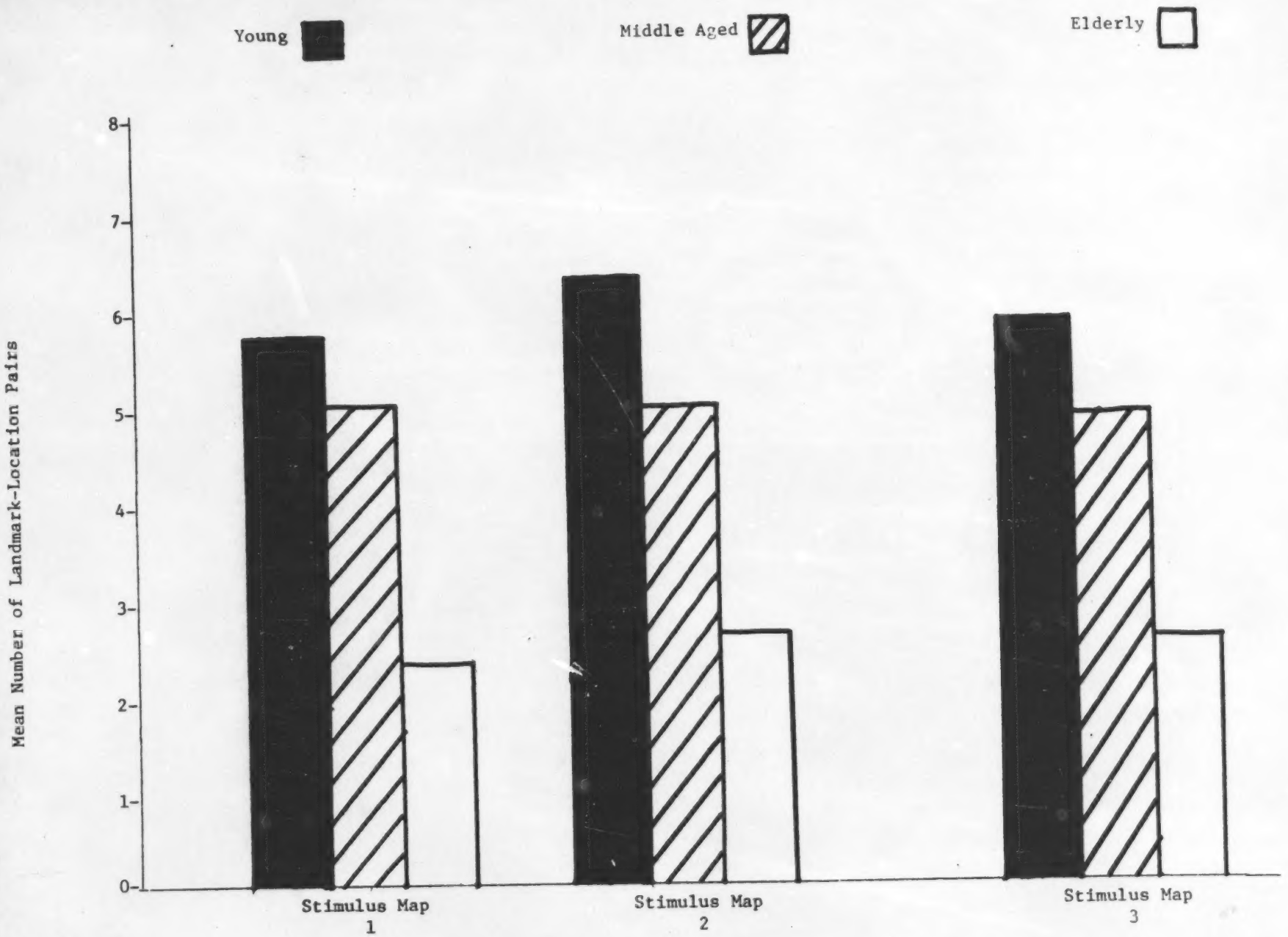
Sample Stimulus Map



Age Differences in Landmark Recognition
Figure 2(a)



Age Differences in Location Recognition
Figure 2(b)



Age Differences in Landmark-Location Pairing
Figure 2(c)